Appendix A. Unit Conversion Chart

Table 80. Metric – English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (g) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 m^3/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[2]	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 ° C = 37.4 °F

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.
[2]The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix B. Threatened and Endangered Species.

Table 81. Threatened, endangered, and sensitive species.

Species	Counties			
	Blaine	Lincoln	Gooding	Jerome
Listed Species				
Canada lynx	X			
Gray wolf	X	X	X	X
Bull trout	X			
Bald eagle	X		X	X
Bliss Rapids snail	X		X	X
Ute ladies'-tresses	X	X	X	X
Utah valvata snail			X	X
Snake River physa snail			X	X
Banbury springs limpet				
Idaho springsnail				
Candidate species				
Slick spot peppergrass				
Sensitive species				
Mammals				
Yuma myotis	X			
Long-eared myotis	X		X	
Long-legged myotis	X			
Western small-footed myotis	X			
Townsend's big eared bat	X	X	X	
Pygmy rabbit	X	X	X	X
Wolverine	X			
Western pipistrelle			X	
Kit fox				
Fisher				
Merriam's shrew				
Fish				
Redband trout	X		X	
Wood River sculpin	X			
Leatherside chub		X		
Shoshone sculpin			X	
White sturgeon				X
Birds				
Columbian sharp-tailed grouse	X			
Greater sage-grouse	X	X	X	X
Yellow-billed cuckoo	X			
White-faced ibis	X			
Trumpeter swan	X		X	
Northern goshawk	X			
Ferruginous hawk	X	X		

Species	Counties			
	Blaine	Lincoln	Gooding	Jerome
Black tern	X			
Long billed curlew	X	X	X	X
Flammulated owl	X			
Boreal owl	X			
Three-toed woodpecker	X			
Western burrowing owl				
Mountain quail				
White-headed woodpecker				
Invertebrates				
Idaho Dunes tiger beetle	X	X		
California floater				X
Amphibians and Reptiles				
Western toad	X	X		X
Northern leopard frog	X	X	X	X
Columbia spotted frog	X	X	X	X
Common garter snake	X	X	X	X
Short-horned lizard	X	X	X	X
Mojave black-collared lizard	X	X	X	
Woodhouse’s toad				
Idaho giant salamander				
Longnose snake				
Ground snake				
Plants				
Slender moonwart	X	X	X	X
Meadow pussytoes	X			
Mourning milkvetch	X	X	X	
Bugleg goldenweed	X			
Obscure phacelia	X			
Least phacelia				
Idaho douglasia				
Davis’ peppergrass				
Lichens				
Wovenspore lichen				

Appendix C. State and Site-Specific Standards and Criteria

Table 82. Surface water criteria.

IDAPA58.01.02	Criteria
200.	**General Surface Water Quality Criteria**. The following general water quality criteria apply to all surface waters of the state, in addition to the water quality criteria set forth for specifically designated waters.
01.	**Hazardous Materials**. Surface waters of the state shall be free from hazardous materials in concentrations found to be of public health significance or to impair designated beneficial uses.
02.	**Toxic Substances**. Surface waters of the state shall be free from toxic substances in concentrations that impair designated beneficial uses.
03.	**Deleterious Materials**. Surface waters of the state shall be free from deleterious materials in concentrations that impair designated uses.
04.	**Radioactive Materials.**
a.	Radioactive materials or radioactivity shall not exceed the values listed in the Code of Federal Regulations, Title 10, Chapter 1, Part 20, Appendix B, Table 2, Effluent Concentrations, Column 2.
b.	Radioactive materials or radioactivity shall not exceed concentrations required to meet the standards set forth in Title 10, Chapter 1, Part 20 of the Code of Federal Regulations for maximum exposure of critical human organs in the case of foodstuffs harvested from these waters for human consumption.
05.	**Floating, Suspended or Submerged Matter.** Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses.
06.	**Excess Nutrients**. Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.
07.	**Oxygen-Demanding Materials**. Surface waters of the state shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.
08.	**Sediment**. Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses.
09.	**Natural Background Conditions**. When natural background conditions exceed any applicable water quality criteria set forth in Sections 210,250, 251, 252, or 253 the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increased above natural background conditions when allowed under Section 401.
250.	**Surface Water Quality Criteria for Aquatic Life Use Designations**
01.	**General Criteria**
a.	Hydrogen Ion Concentration(pH) values within the range of 6.5 to 9.0
b.	The total concentration of dissolved gas not exceeding 110% of saturation at atmospheric pressure at the point of sample collection
c.	Total chlorine residual. One hour average concentration not to exceed 19ug/l or four day average concentration not to exceed 11ug/l
02.	**Cold Water**

IDAPA58.01.02	Criteria
a.	Dissolved Oxygen Concentrations exceeding 6 mg/L at all times. In lakes and reservoirs this standard does not always apply
b.	Water temperatures of 22 degrees C or less with a maximum daily average of no greater than 19 degrees C.
c.	Temperature in lakes shall have no measurable change from natural background conditions.
d.	Ammonia. The following criteria are not to be exceeded dependent on the temperature and pH of the water body
i.	Acute Criterion. The one hour average concentration of total ammonia nitrogen is not to exceed more than once every 3 years, the calculated CMC value
ii.	Chronic Criterion. The thirty day average concentration of total ammonia nitrogen is not to exceed, more than once every 3 years, the calculated CCC value.
d.	Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than 50NTU instantaneously or more than 25 NTU for more than 10 consecutive days.
e.	Salmonid spawning: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters:
i.(1)	Dissolved Oxygen. Intergravel dissolved oxygen. One day minimum of not less than 5.0 mg/L.
i.(2)	Water-Column dissolved Oxygen. One day minimum of not less than 6.0 mg/L or 90% of saturation, whichever is greater
ii.	Water temperatures of 13 degrees C or less with a maximum daily average no greater than 9 degrees C
251.	**Surface water quality criteria for recreation use designations**
01.	Primary Contact recreation. Waters designated for primary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding
b.	For all other waters designated for primary contact recreation, a single sample of four hundred six *E. coli* organisms per 100ml or
c.	A geometric mean of 126 *E. coli* organisms per 100ml based on a minimum of 5 samples taken every 3 to 5 days over a 30 day period.
02.	Secondary Contact recreation. Waters designated for secondary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding:
a.	A single sample of 576 *E. coli* organisms per 100ml or
b.	A geometric mean of 126 *E. coli* organisms per 100 ml based on a minimum of 5 samples taken every 3 to 5 days over a 30day period.
252.	**Surface Water Quality Criteria for Water Supply Use Designation**
02.	Agricultural. Water quality criteria for agricultural water supplies will generally be satisfied by the water quality criteria set for in Section 200.
03.	Industrial. Water quality criteria for industrial water supplies will generally be satisfied by the general water quality criteria set forth in Section 200.
253.	**Surface Water Quality Criteria for Wildlife and Aesthetic Use Designations**
01.	Wildlife Habitats. Water quality criteria for wildlife habitats will generally be satisfied by the general water quality criteria set forth in Section 200.
02.	Aesthetics. Water quality criteria for aesthetics will generally be satisfied by the general water quality criteria set forth in Section 200.

IDAPA58.01.02	Criteria
401.03	**Treatment Requirements**. Unless more stringent limitations are necessary to meet the applicable requirements of Sections 200 through 300 or unless specific exemptions are made pursuant to Subsection 080.02 or 401.05, wastewaters discharged into surface waters of the state must have the following characteristics:
a.	Temperature-the wastewater must not affect the receiving water outside the mixing zone so that
i.	The temperature of the receiving water or of downstream waters will interfere with designated beneficial uses
ii.	Daily and seasonal temperature cycles characteristic of the water body are not maintained
iii.	If the water is designated for warm water aquatic life, the induced variation is more than plus two (+2) degrees C
iv.	If the water is designated for cold water aquatic life, seasonal cold water aquatic life, or salmonid spawning, the induced variation is more than plus one (+1) degree C.
v.	If temperature criteria for the designated aquatic life use are exceeded in the receiving waters upstream of the discharge due to natural background conditions, then Subsections 401.03.a.iii. and 401.03.a.iv. do not apply and instead wastewater must not raise the receiving water temperatures by more than three tenths (0.3) degrees C.

[a] Criteria copied from Water Quality Standards and Wastewater Treatment Requirements.

Appendix D. Geology of Fish Creek Reservoir

General Description of Geology of the area near Fish Creek Dam, Blaine County Idaho

Prepared by Terril Stevenson
USDA, NRCS Idaho
July 23, 2003

Fish Creek Dam and Reservoir are located in the Pioneer Mountains along the northern edge of the Snake River Plain. The dam and reservoir are in the small (narrow) alluvial valley of Fish Creek. Fish Creek flows to the south and then west to Carey Lake. This drainage pattern is controlled by the recent (Quaternary Age) basalt flows associated with the Craters of the Moon and Great Rift volcanic area to the south and east.

The dam and reservoir are in the border zone between the Eastern Snake River Plain and the Northern Rocky Mountain Geomorphic Provinces. Mountains on the west side of the area are formed by block- and thrust-faulted, folded, predominantly Tertiary Age Challis Volcanics rocks consisting of welded volcanic tuff, latite and andesite conglomerates. Mountains on the east side are formed in Paleozoic age sedimentary rocks consisting mainly of dolomites, limestones, and calcareous argillites or claystones. Bedrock on the east side has also been thrust and block faulted.

The slopes that form the valley walls immediately adjacent to the dam are faulted Paleozoic rock. There appears to be a major thrust fault trending northwest-southeast that bisects the valley at about the location of the dam. Additionally, there is an inferred block fault that follows the trace of the valley, trending north-northeast. The Paleozoic rock sequence is partially repeated as a result of the faulting.

The alluvial valley is partially filled with Quaternary Age basalt. The dam is constructed over basalt. Shallow deposits of Quaternary Age loess (windblown sediment) overlie the basalt. Coarse colluvium and alluvial fan deposits of clay, silt, sand and gravel have formed at the base of the mountains throughout the area.

The Paleozoic Formations mapped in the area include:
- Wood River Formation: calcareous siltstone, argillite, sandstone, and limestone.
- Copper Basin Formation: limestone, sandstone, siltstone, and argillite.
- Picabo Formation: dolomite.
- Three Forks Limestone: limestone and shale.
- Jefferson Dolomite.
- Carey Dolomite.
- Roberts Mountain Formation: limestone, siltstone.

None of these Formations contain phosphates in commercial quantities however dolomite, shale, limestone, and argillite typically contain higher levels of phosphorus than other rock types. Additionally, the Paleozoic rock section places the Phosphoria Formation stratigraphically as the next unit above the Wood River Formation. The Phosphoria Formation has not been mapped in the area but is found with these same Formations in southeastern Idaho, Utah, Wyoming and Montana.

Loess and alluvial sediments derived from these formations may contain significant phosphorus. Ground and surface water associated with these sediments may exhibit background levels of phosphorus that are higher than water in sediment derived from other Formations.

Geology References:

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Whitehead, R. L., 1986, Geohydrologic Framework of the Snake River Plain, Idaho and Eastern Oregon; USGS Atlas HA-681, 3 Plates.

Appendix E. Stream Bank Inventory Information.

This appendix includes the segment breaks for the stream bank erosion inventories completed for each creek that has had a sediment TMDL completed and the methodology for the NRCS Stream Bank Erosion Inventory Process.

Table 83 identifies the segment breaks for each segment of the creeks that have had sediment TMDLs completed.

Table 83. Stream bank segments in the Little Wood River Subbasin.

Creek	Segment	Upper GPS point			Lower GPS point		
		deg	min	sec	deg	min	sec
Dry Creek	Upper	43	22	47	43	20	31
		114	06	06	114	02	09
	Middle	43	20	31	43	19	43
		114	02	09	114	00	05
	Lower	43	19	43	43	17	15
		114	00	05	113	56	56
Fish Creek (Above the Reservoir)	Upper	43	34	54	43	33	10
		113	42	25	113	43	27
	Upper Middle	43	33	10	43	32	17
		113	43	27	113	44	59
	Lower Middle	43	32	17	43	46	42
		113	44	59	113	46	42
	Lower	43	46	42	43	25	58
		113	46	42	113	48	38
Fish Creek (Below the Reservoir)	Upper	43	25	20	43	24	03
		113	49	53	113	49	25
	Middle	43	24	03	43	23	11
		113	49	25	113	49	25
	Lower	43	23	11	43	22	22
		113	49	03	113	50	04
Little Wood River (Segment #4)	Upper	43	11	56	43	02	37
		114	00	36	114	08	17
	Middle	43	02	37	42	56	48
		114	08	17	114	22	53
	Lower	42	56	48	43	56	37
		114	22	53	114	47	41

The following information has been provided by Melissa Thompson (DEQ) in 2005 and describes the methodology of the NRCS Stream Bank Erosion Inventory Process.

The stream bank erosion inventory was used to estimate background and existing stream bank erosion following methods outlined in the proceedings from the Natural Resource

Conservation Service (NRCS) Channel Evaluation Workshop (NRCS, 1983). Using the direct volume method, sub-sections of 1998 §303(d) watersheds were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

Stream bank Erosion Inventory

The NRCS Stream bank Erosion Inventory is a field based methodology, which measures stream bank/channel stability, length of active eroding banks, and bank geometry (Stevenson, 1994). The stream bank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of stream bank characteristics that are assigned a categorical rating ranging from 0 to 3. The categories of rating the factors and rating scores are:

Bank Stability:
- Do not appear to be eroding - 0
- Erosion evident - 1
- Erosion and cracking present - 2
- Slumps and clumps sloughing off - 3

Bank Condition:
- Some bare bank, few rills, no vegetative overhang - 0
- Predominantly bare, some rills, moderate vegetative overhang - 1
- Bare, rills, severe vegetative overhang, exposed roots - 2
- Bare, rills and gullies, severe vegetative overhang, falling trees - 3

Vegetation / Cover On Banks:
- Predominantly perennials or rock-covered - 0
- Annuals / perennials mixed or about 40% bare - 1
- Annuals or about 70% bare - 2
- Predominantly bare – 3

Bank / Channel Shape:
- V - Shaped channel, sloped banks - 0
- Steep V - Shaped channel, near vertical banks - 1
- Vertical Banks, U - Shaped channel - 2
- U - Shaped channel, undercut banks, meandering channel - 3

Channel Bottom:
- Channel in bedrock / noneroding - 0
- Soil bottom, gravels or cobbles, minor erosion - 1
- Silt bottom, evidence of active downcutting - 2

Deposition:
- No evidence of recent deposition - 1
- Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4) Moderate (5-8) Severe (9+)

From the Cumulative Rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year **Slight**

0.06 - 0.15 feet per year **Moderate**

0.16 - 0.3 feet per year	**Severe**
0.5+ feet per year	**Very Severe**

Stream bank stability can also be characterized through the following definition and the corresponding stream bank erosion condition rating from Bank Stability or Bank Condition above are included in italics.

Stream banks are considered stable if they do not show indications of any of the following features:

- **Breakdown** - Obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*
- **Slumping or False Bank** - Bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*
- **Fracture** - A crack is visibly obvious on the bank indicating that the block of bank I about to slump or move into the stream. *Bank Stability Rating 2*
- **Vertical and Eroding** - The bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Stream banks are considered covered if they show any of the following features:

- Perennial vegetation ground cover is greater than 50%. *Vegetation/Cover Rating 0*
- Roots of vegetation cover more than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
- At least 50% of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*
- At least 50% of the bank surfaces are protected by logs of 4 inch diameter or larger. *Vegetation/Cover Rating 1*

Stream bank stability is estimated using a simplified modification of Platts, Megahan, and Minshall (1983, p. 13) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton, 1993). The modification allows for measuring stream bank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

- **Mostly covered and stable (non-erosional).** Stream banks are Over 50% Covered as defined above. Stream banks are Stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*
- **Mostly covered and unstable (vulnerable).** Stream banks are Over 50% Covered as defined above. Stream banks are Unstable as defined above. Such banks are typical of "false banks" observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*

- **Mostly uncovered and stable (vulnerable).** Stream banks are less than 50% Covered as defined above. Stream banks are Stable as defined above. Uncovered, stable banks are typical of stream banks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and unstable (erosional).** Stream banks are less than 50% Covered as defined above. They are also Unstable as defined above. These are bare eroding stream banks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Stream banks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to be used for TMDL development.

<u>Site Selection</u>

The first step in the bank erosion inventory is to identify key problem areas. Stream bank erosion tends to increase as a function of watershed area (NRCS, 1983). As a result, the lower stream segments of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches (Rosgen B and C channel types) (Rosgen,1996).

Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates are extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need less. Typically between 10 and 30 percent of stream bank needs to be inventoried. Often, the location of some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private land owners are sometimes unwilling to allow access to stream segments within their property.
Stream reaches are subdivided into *sites* with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. Subdivision of stream reaches is at the discretion of the field crew leader.

<u>Field Methods</u>

Stream bank erosion or channel stability inventory field methods were originally developed by the USDA USFS (Pfankuch, 1975). Further development of channel stability inventory methods are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods were made and are documented.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rate determined in the survey (NRCS, 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor.

The direct volume method is summarized in the following equations:

$E = [A_E * R_{LR} * \quad_B\,]/2000$ (lbs/ton)

where:

E = bank erosion over sampled stream reach (tons/yr/sample reach)

A_E = eroding area (ft^2)

R_{LR} = lateral recession rate (ft/yr)

$\quad_B$ = bulk density of bank material (lps/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$E_R = E/L_{BB}$

where:

E_R = bank erosion rate (tons/mile/year)

E = bank erosion over sampled stream reach (tons/yr/sample reach)

L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold et al, 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value should be considered a long term average. For example, a 50 year flood event might cause five feet of bank erosion in one year and over a ten year period this events accounts for the majority of bank erosion. These factors have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding. For example, the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS, 1983). Several techniques are available to quantify bank erosion rates:

for example, aerial photo interpretation, anecdotal data, bank pins, and channel cross-sections.

To facilitate consistent data collection, the NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates.

The *bulk density* (ρ_B) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

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Appendix F. Information Related to Temperature.

This appendix includes the segment breaks for the canopy cover targets and existing loads, solar path finder field data comparisons to aerial photo interpretations, and the methodology for the aerial photo interpretation.

Table 84 identifies the segment breaks and existing and potential load for each segment of the creeks that have had temperature TMDLs completed. ArcView maps of the creeks showing existing canopy cover and canopy cover targets can be obtained at the DEQ Twin Falls office.

Table 84. Canopy cover estimates and targets.

Water body	Segment	SL (miles)	EC (%)	ESL (kWh/day)	TC (%)	PSL (kWh/day)	EL - PL (kWh/day)
Muldoon Creek	Upper	1.75	0.5	39,530.3	0.65	27,671.2	11,859.1
		0.5	0.6	9,035.5	0.65	7,906.1	1,129.4
		2.2	0.5	49,695.3	0.65	34,786.7	14,908.6
		0.5	0.6	9,035.5	0.65	7,906.1	1,129.4
		0.5	0.5	11,294.4	0.65	7,906.1	3,388.3
	Middle	1.75	0.4	91,638.5	0.45	84,001.9	7,636.5
		0.3	0.3	18,327.7	0.45	14,400.3	3,927.4
		0.25	0.4	13,091.2	0.45	12,000.3	1,090.9
		0.5	0.5	21,818.7	0.45	24,000.5	0.0
		0.5	0.4	26,182.4	0.45	24,000.5	2,181.9
		0.25	0.2	17,454.9	0.45	12,000.3	5,454.7
		0.5	0.4	26,182.4	0.45	24,000.5	2,181.9
		0.6	0.3	36,655.4	0.45	28,800.7	7,854.7
		1.4	0.2	97,747.7	0.45	67,201.5	30,546.2
	Lower	0.6	0.3	46,142.7	0.37	41,528.4	4,614.3
		0.2	0.5	10,986.3	0.37	13,842.8	0.0
		1	0.4	65,918.1	0.37	69,214.0	0.0
		0.25	0.5	13,732.9	0.37	17,303.5	0.0
		0.25	0.4	16,479.5	0.37	17,303.5	0.0
Fish Creek below reservoir		0.7	0.4	28,030.6	0.35	30,366.5	0.0
		1.2	0.3	56,061.2	0.35	52,056.8	4,004.4
		0.8	0.4	32,035.0	0.35	34,704.5	0.0
		0.4	0.2	21,356.6	0.35	17,352.3	4,004.4
		0.5	0.3	23,358.8	0.35	21,690.3	1,668.5
		0.5	0.4	20,021.8	0.35	21,690.3	0.0
		0.2	0.1	12,013.1	0.35	8,676.1	3,337.0
		0.2	0.2	10,678.3	0.35	8,676.1	2,002.2
		0.7	0.1	42,045.9	0.35	30,366.5	11,679.4
		1.5	0.1	90,098.3	0.35	65,071.0	25,027.3
		3	0	200,218.5	0.35	130,142.0	70,076.5
Fish Creek above reservoir	Upper	0.5	0.4	8,316.8	0.6	5,544.5	2,772.3
		0.25	0.6	2,772.3	0.6	2,772.3	0.0

Water body	Segment	SL (miles)	EC (%)	ESL (kWh/day)	TC (%)	PSL (kWh/day)	EL - PL (kWh/day)
		0.5	0.4	8,316.8	0.6	5,544.5	2,772.3
		1.2	0.5	16,633.5	0.6	13,306.8	3,326.7
		0.6	0.4	9,980.1	0.6	6,653.4	3,326.7
		0.5	0.6	5,544.5	0.6	5,544.5	0.0
	Middle	0.8	0.4	25,628.0	0.6	17,085.3	8,542.7
		0.2	0.6	4,271.3	0.6	4,271.3	0.0
		0.5	0.5	13,347.9	0.6	10,678.3	2,669.6
		0.3	0.4	9,610.5	0.6	6,407.0	3,203.5
		1.7	0.5	45,382.9	0.6	36,306.3	9,076.6
		0.3	0.4	9,610.5	0.6	6,407.0	3,203.5
		0.3	0.3	11,212.2	0.6	6,407.0	4,805.2
	Lower	0.5	0.4	14,169.3	0.45	12,988.5	1,180.8
		0.6	0.5	14,169.3	0.45	15,586.2	0.0
		0.5	0.2	18,892.4	0.45	12,988.5	5,903.9
		0.2	0.5	4,723.1	0.45	5,195.4	0.0
		0.7	0.2	26,449.4	0.45	18,183.9	8,265.4
		0.2	0.5	4,723.1	0.45	5,195.4	0.0
		0.2	0.2	7,557.0	0.45	5,195.4	2,361.6
		1	0.5	23,615.5	0.45	25,977.1	0.0
		0.4	0.2	15,113.9	0.45	10,390.8	4,723.1
Loving Creek	Upper	0.2	0	18,687.1	0.2	14,949.6	3,737.4
	Middle	0.8	0.3	35,074.2	0.45	27,558.3	7,515.9
		0.5	0.4	18,789.7	0.45	17,223.9	1,565.8
		0.8	0.2	40,084.8	0.45	27,558.3	12,526.5
		0.5	0.4	18,789.7	0.45	17,223.9	1,565.8
		0.6	0.4	22,547.7	0.45	20,668.7	1,879.0
		0.8	0.1	45,095.4	0.45	27,558.3	17,537.1
		0.2	0.4	7,515.9	0.45	6,889.6	626.3
		1.5	0.2	75,158.9	0.45	51,671.8	23,487.2
	Upper lower	1.1	0	223,628.6	0.1	201,265.8	22,362.9
	Lower lower	0.2	0.4	17,988.9	0.28	21,586.6	0.0
		0.4	0.1	53,966.6	0.28	43,173.3	10,793.3
Little Wood River Segment 1	Upper	1	0.7	27,414.5	0.4	54,829.1	0.0
		0.5	0.5	22,845.4	0.4	27,414.5	0.0
		0.5	0.4	27,414.5	0.4	27,414.5	0.0
		0.5	0.5	22,845.4	0.4	27,414.5	0.0
		0.6	0.4	32,897.4	0.4	32,897.4	0.0
		1.2	0.6	43,863.3	0.4	65,794.9	0.0
		1	0.5	45,690.9	0.4	54,829.1	0.0
		0.7	0.4	38,380.3	0.4	38,380.3	0.0
		0.5	0.5	22,845.4	0.4	27,414.5	0.0
		0.5	0.3	31,983.6	0.4	27,414.5	4,569.1
		0.8	0.4	43,863.3	0.4	43,863.3	0.0
		0.6	0.3	38,380.3	0.4	32,897.4	5,482.9
		0.3	0.4	16,448.7	0.4	16,448.7	0.0
		1	0.3	63,967.2	0.4	54,829.1	9,138.2

Water body	Segment	SL (miles)	EC (%)	ESL (kWh/day)	TC (%)	PSL (kWh/day)	EL - PL (kWh/day)
		0.3	0.4	16,448.7	0.4	16,448.7	0.0
		0.8	0.3	51,173.8	0.4	43,863.3	7,310.5
	Middle	0.4	0.2	43,041.8	0.4	32,281.4	10,760.5
		0.2	0.3	18,830.8	0.4	16,140.7	2,690.1
		0.3	0.4	24,211.0	0.4	24,211.0	0.0
		0.6	0.3	56,492.4	0.4	48,422.1	8,070.3
		0.5	0.5	33,626.4	0.4	40,351.7	0.0
		0.3	0.4	24,211.0	0.4	24,211.0	0.0
		0.2	0.2	21,520.9	0.4	16,140.7	5,380.2
		0.7	0.4	56,492.4	0.4	56,492.4	0.0
		0.2	0.5	13,450.6	0.4	16,140.7	0.0
		0.5	0.3	47,077.0	0.4	40,351.7	6,725.3
		0.4	0.2	43,041.8	0.4	32,281.4	10,760.5
		0.2	0.3	18,830.8	0.4	16,140.7	2,690.1
		0.3	0.4	24,211.0	0.4	24,211.0	0.0
		0.3	0.3	28,246.2	0.4	24,211.0	4,035.2
		0.3	0.2	32,281.4	0.4	24,211.0	8,070.3
	Lower	0.6	0.4	50,639.9	0.4	50,639.9	0.0
		1.4	0.3	137,853.0	0.4	118,159.7	19,693.3
Little Wood River Segment 4	Upper	0.4	0.1	41,768.7	0.15	39,448.2	2,320.5
		0.5	0.2	46,409.6	0.15	49,310.2	0.0
		0.6	0.3	48,730.1	0.15	59,172.3	0.0
		0.3	0.2	27,845.8	0.15	29,586.1	0.0
		0.2	0.3	16,243.4	0.15	19,724.1	0.0
		0.4	0.2	37,127.7	0.15	39,448.2	0.0
		0.4	0.1	41,768.7	0.15	39,448.2	2,320.5
		2.5	0.2	232,048.1	0.15	246,551.1	0.0
		0.3	0.3	24,365.0	0.15	29,586.1	0.0
		0.6	0.2	55,691.5	0.15	59,172.3	0.0
		0.6	0.3	48,730.1	0.15	59,172.3	0.0
		1.2	0.2	111,383.1	0.15	118,344.5	0.0
		1	0.1	104,421.6	0.15	98,620.4	5,801.2
		2	0.2	185,638.5	0.15	197,240.9	0.0
		2	0.1	208,843.3	0.15	197,240.9	11,602.4
		0.3	0.2	27,845.8	0.15	29,586.1	0.0
	Upper middle	1.4	0.3	83,516.8	0.3	83,516.8	0.0
		0.5	0.4	25,566.4	0.3	29,827.4	0.0
		1	0.3	59,654.8	0.3	59,654.8	0.0
		0.8	0.2	54,541.6	0.3	47,723.9	6,817.7
		0.3	0.1	23,009.7	0.3	17,896.5	5,113.3
		0.9	0.2	61,359.3	0.3	53,689.4	7,669.9
		0.6	0.4	30,679.6	0.3	35,792.9	0.0
		0.7	0.5	29,827.4	0.3	41,758.4	0.0
		0.3	0.4	15,339.8	0.3	17,896.5	0.0
		0.3	0.3	17,896.5	0.3	17,896.5	0.0
		0.2	0.4	10,226.5	0.3	11,931.0	0.0

Water body	Segment	SL (miles)	EC (%)	ESL (kWh/day)	TC (%)	PSL (kWh/day)	EL - PL (kWh/day)
		0.6	0.3	35,792.9	0.3	35,792.9	0.0
		0.3	0.2	20,453.1	0.3	17,896.5	2,556.6
		1.2	0.3	71,585.8	0.3	71,585.8	0.0
		0.7	0.2	47,723.9	0.3	41,758.4	5,965.5
		1.2	0.3	71,585.8	0.3	71,585.8	0.0
		0.2	0.2	13,635.4	0.3	11,931.0	1,704.4
		0.3	0.3	17,896.5	0.3	17,896.5	0.0
		1.2	0.2	81,812.4	0.3	71,585.8	10,226.5
		0.7	0.3	41,758.4	0.3	41,758.4	0.0
		0.6	0.4	30,679.6	0.3	35,792.9	0.0
		0.5	0.3	29,827.4	0.3	29,827.4	0.0
		1	0.4	51,132.7	0.3	59,654.8	0.0
		0.6	0.1	46,019.4	0.3	35,792.9	10,226.5
	Lower middle	0.4	0	31,213.5	0.35	20,288.8	10,924.7
		0.2	0.2	12,485.4	0.35	10,144.4	2,341.0
		0.3	0.3	16,387.1	0.35	15,216.6	1,170.5
		0.4	0.4	18,728.1	0.35	20,288.8	0.0
		0.2	0.2	12,485.4	0.35	10,144.4	2,341.0
		0.4	0.3	21,849.5	0.35	20,288.8	1,560.7
		0.5	0.1	35,115.2	0.35	25,361.0	9,754.2
		0.4	0.2	24,970.8	0.35	20,288.8	4,682.0
		0.3	0.3	16,387.1	0.35	15,216.6	1,170.5
		0.5	0.2	31,213.5	0.35	25,361.0	5,852.5
		0.4	0.1	28,092.2	0.35	20,288.8	7,803.4
		0.2	0.2	12,485.4	0.35	10,144.4	2,341.0
		0.3	0.4	14,046.1	0.35	15,216.6	0.0
		0.3	0.2	18,728.1	0.35	15,216.6	3,511.5
		0.2	0.3	10,924.7	0.35	10,144.4	780.3
		0.3	0.2	18,728.1	0.35	15,216.6	3,511.5
		0.4	0.1	28,092.2	0.35	20,288.8	7,803.4
		1	0.2	62,427.1	0.35	50,722.0	11,705.1
		1	0.1	70,230.5	0.35	50,722.0	19,508.5
		0.3	0.2	18,728.1	0.35	15,216.6	3,511.5
		0.5	0.1	35,115.2	0.35	25,361.0	9,754.2
		0.5	0	39,016.9	0.35	25,361.0	13,655.9
		0.3	0.2	18,728.1	0.35	15,216.6	3,511.5
		0.7	0.1	49,161.3	0.35	35,505.4	13,655.9
		0.2	0.2	12,485.4	0.35	10,144.4	2,341.0
		0.3	0.1	21,069.1	0.35	15,216.6	5,852.5
		0.5	0.3	27,311.9	0.35	25,361.0	1,950.8
		1	0.4	46,820.3	0.35	50,722.0	0.0
	Lower	0.6	0.3	28,461.8	0.4	24,395.9	4,066.0
		0.5	0.2	27,106.5	0.4	20,329.9	6,776.6
		0.4	0.5	13,553.3	0.4	16,263.9	0.0
		1	0.3	47,436.4	0.4	40,659.8	6,776.6
		0.3	0.4	12,197.9	0.4	12,197.9	0.0

Water body	Segment	SL (miles)	EC (%)	ESL (kWh/day)	TC (%)	PSL (kWh/day)	EL - PL (kWh/day)
		0.4	0.2	21,685.2	0.4	16,263.9	5,421.3
		0.2	0.3	9,487.3	0.4	8,132.0	1,355.3
		0.9	0.4	36,593.8	0.4	36,593.8	0.0
		0.3	0.2	16,263.9	0.4	12,197.9	4,066.0
		0.3	0.1	18,296.9	0.4	12,197.9	6,099.0
		1	0	67,766.3	0.4	40,659.8	27,106.5
		0.3	0.2	16,263.9	0.4	12,197.9	4,066.0
		0.4	0.4	16,263.9	0.4	16,263.9	0.0
		0.3	0.3	14,230.9	0.4	12,197.9	2,033.0
		0.5	0.2	27,106.5	0.4	20,329.9	6,776.6
		0.5	0.4	20,329.9	0.4	20,329.9	0.0
		0.4	0.3	18,974.6	0.4	16,263.9	2,710.7
		0.5	0.2	27,106.5	0.4	20,329.9	6,776.6
		0.4	0.1	24,395.9	0.4	16,263.9	8,132.0
		1	0.2	54,213.0	0.4	40,659.8	13,553.3

[a] SL – segment length, EC – existing canopy cover, ESL – existing summer load, TC – target canopy cover, PSL – proposed summer load, EL – PL – existing load minus proposed load, kWh/day – kilowatt hours per day.

Table 85 identifies the similarities between aerial photo interpretations and solar path finder field data for canopy cover.

Table 85. Aerial versus pathfinder data.

Water body	Average Annual Shade	Average Summer Shade	Aerial Photo Cover	Aerial minus Summer Average	Aerial minus Annual Average
Fish Creek (above reservoir)	54.4	44.3	40	-4.3	-14.4
Fish Creek (below reservoir)	58.4	51.5	40	-11.5	-18.4
Muldoon Creek (mouth)	54.8	29.9	40	10.1	-14.8
Little Wood River (above reservoir)	34.7	27.6	30	2.4	-4.7
Little Wood River (Bear Track Williams)	8.9	2.4	20	17.6	11.1
Average	42.2	31.1	34	2.9	-8.2

[a] Pathfinder data provided by DEQ Twin Falls, Aerial Photo interpretation provided by Mark Shumar (DEQ state office).

The following information was provided by Mark Shumar (DEQ) in 2005 and describes the usage of potential natural vegetation for temperature TMDLs and the methodology for aerial photo interpretation of canopy cover.

Potential Natural Vegetation for Temperature TMDLs

There are a several important contributors of heat to a stream including ground water temperature, air temperature and direct solar radiation. Of these, direct solar radiation is the source of heat that is easiest to control or manipulate. The parameter that affects or controls the amount of solar radiation hitting a stream throughout its length is shade. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Again, the amount of shade provided by objects other than vegetation is not easy to control or manipulate. This leaves vegetation as the most likely source of change in solar radiation hitting a stream.

Depending on how much vertical elevation also surrounds the stream, vegetation further away from the riparian corridor can provide shade. However, riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. We can measure the amount of shade that a stream enjoys in a number of ways. Effective shade, that shade provided by all objects that intercept the sun as it makes its way across the sky, can be measured in a given spot with a solar pathfinder or with optical equipment similar to a fish-eye lens on a camera. Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and the stream's aspect. In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream, and can be measured using a densiometer, or estimated visually either on site or on aerial photography. All of these methods tell us information about how much the stream is covered and how much of it is exposed to direct solar radiation.

Potential natural vegetation (PNV) along a stream is that intact riparian plant community that has grown to its fullest extent and has not been disturbed or reduced in anyway. The PNV can be removed by disturbance either naturally (wildfire, disease/old age, wind-blown, wildlife grazing) or anthropogenically (domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides the most shade and the least achievable solar loading to the stream. Anything less than PNV is allowing the stream to heat up from excess solar inputs. We can estimate PNV from models of plant community structure (shade curves for specific riparian plant communities), and we can measure existing vegetative cover or shade. Comparing the two will tell us how much excess solar load the stream is receiving, and what can be done to decrease solar gain.

Existing shade or cover will be estimated for entire lengths of streams from visual observations of aerial photos. These estimates can be field verified by measuring shade with solar pathfinders or cover with densiometers at randomly or systematically located points along the stream (see below for methodology). PNV will be determined from existing shade curves developed for similar vegetation communities. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, the shade decreases as the vegetation has less ability to shade the center of wide streams. Existing and PNV shade can be converted to solar load from data collected on flat plate collectors at the nearest weather station collecting these data. The difference between existing and potential solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards. Existing shade cannot be greater than PNV shade, thus existing loads cannot be less than PNV loads. PNV shade and loads are assumed to be the natural condition, thus stream temperatures under PNV conditions are considered to be the lowest achievable temperatures (so long as there are no point sources or any other anthropogenic sources of heat in the watershed).

Pathfinder Methodology

The solar pathfinder is a device that allows one to trace the outline of shade producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the spot that the tracing is made. In order to adequately characterize the effective shade on a stream, as many of these traces as possible should be taken at systematic or random intervals along the length of the stream in question. At a minimum, five charts should be taken to be averaged to represent shade on a stream reach.

At each sampling location the solar pathfinder should be placed in the middle of the stream about one foot above the water. Follow the manufacturer's instructions (orient to true south and level) for taking traces. Systematic sampling is easiest to accomplish and still not bias the location of sampling. Start at a unique location such as 100 m from a bridge or fence line and then proceed upstream or downstream stopping to take additional traces at fixed intervals (e.g. every 100m, every half-mile, every degree change on a GPS, every 0.5 mile change on an odometer, etc.). On can also randomly locate points of measurement by generating random numbers to be used as interval distances. The more traces the better, for example, if the stream is four miles long paralleled by a road, you could stop at every ¼ mile to take a trace resulting in a good number of traces (about 17). If you stopped at every 0.1 mile interval, you could take over 40 traces.

It is a good idea to take notes while taking solar pathfinder traces, and to photograph the stream at several unique locations. Pay special attention to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade producing ones) are present. Additionally, one can take densiometer readings at the same location as solar pathfinder traces. This provides the potential to develop relationships between canopy cover and effective shade for a given stream.

Aerial Photo Interpretation

Canopy coverage estimates are provided for 200-foot elevational intervals, or natural breaks in vegetation density, marked out on a 1:100K hydrography. Each interval is assigned a single value representing the bottom of a 10% canopy coverage class as described below (*adapted from the CWE process, IDL, 2000*):

Cover class	**Typical vegetation type**
0 = 0 – 9% cover	agricultural land, denuded areas
10 = 10 –19%	ag land, meadows, open areas, clearcuts

20 = 20 – 29%	ag land, meadows, open areas, clearcuts
30 = 30 – 39%	ag land, meadows, open areas, clearcuts
40 = 40 – 49%	shrublands/meadows
50 = 50 – 59%	shrublands/meadows, open forests
60 = 60 – 69%	shrublands/meadows, open forests
70 = 70 – 79%	forested
80 = 80 – 89%	forested
90 = 90 –100%	forested

Additionally, a code can be provided to indicate condition or type of vegetation seen at that interval. These codes are as follows:

N = natural forest or larger than a buffer area around stream
B = buffer area around stream, cut or open area with a short distance from stream
C = opening or clearcut on stream itself (stream exposed)
M = meadow/shrubland or alpine type
NA = In some cases no recognizable channel was seen on the photo even though the map shows a stream at 1:100K hydrography. In these few instances we have marked them as NA, no channel visible. Doesn't mean that there is not something down there, we just can't see it.

The visual estimates of cover should be field verified with either a densiometer or a solar pathfinder. The pathfinder measures effective shade and is taking into consideration other physical features that block the sun from hitting the stream surface (e.g. hillsides, canyon walls, terraces, man-made structures). The densiometer simply measures the more immediate canopy surrounding the stream. The estimate of cover made visually from an aerial photo does not take into account topography or any shading that may occur from physical features other than vegetation. However, research has shown that measurements taken by the two techniques are remarkably similar (OWEB, no date).

References

IDL. 2000. Forest Practices Cumulative Watershed Effects Process for Idaho. Idaho Department of Lands. March 2000.

OWEB. (no date). Addendum to Water Quality Monitoring Technical Guide Book: Chapter 14 Stream Shade and Canopy Cover Monitoring Methods. Oregon's Watershed Enhancement Board. 775 Summer St. NE., Suite 360, Salem, OR 97301-1290.

Appendix G. Implementation Strategies

Little Wood River Implementation Strategies

As part of the Little Wood River Total Maximum Daily Load

Little Wood River (2511)

Boundary: Richfield town to Big Wood River
Primary Pollutant-of-Concern: Nutrients, Sediment, Temperature, Flow Alteration
TMDLs Completed: Nutrient, Sediment, Temperature
Delisting: Bacteria and Dissolved Oxygen
TMDL Modification: Waterbody is meeting standards for Bacteria and Dissolved Oxygen
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Little Wood River (2512)

Boundary: Silver Creek to Richfield town
Primary Pollutant-of-Concern: Nutrients, Sediment, Temperature, Flow Alteration
TMDLs Completed: Nutrient, Sediments, Temperature
Delisting: NA
TMDL Modification: Upstream segment is dewatered
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDFG	2025		
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Little Wood River (2513)

Boundary: East Canal Diversion to Silver Creek
Primary Pollutant-of-Concern: Flow Alteration
TMDLs Completed: None
Delisting: Nutrients, Sediment, Temperature
TMDL Modification: Dewatered segment
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2004	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2004	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2004	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2004	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Little Wood River Reservoir (2515)

Boundary: The entire Little Wood River Reservoir
Primary Pollutant-of-Concern: Flow Alteration
TMDLs Completed: None
Delisting: Bacteria, Dissolved Oxygen, Nutrients, Sediment
TMDL Modification: Waterbody is meeting standards for Bacteria, Dissolved Oxygen, Nutrients, and Sediment
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2004	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2004	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2004	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2004	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Little Wood River ()

Boundary: Headwaters of the Little Wood River to the reservoir
Primary Pollutant-of-Concern: Temperature
TMDLs Completed: Temperature
Delisting: None
TMDL Modification: Waterbody is meeting beneficial uses and standards for other analytes
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Dry Creek (2521)

Boundary: Headwaters to Little Wood River
Primary Pollutant-of-Concern: Sediment, Flow Alteration
TMDLs Completed: Sediment
Delisting: Bacteria, Dissolved Oxygen, Nutrients
TMDL Modification: Waterbody is meeting standards for Bacteria, Dissolved Oxygen, and Nutrients
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Fish Creek Reservoir (2523)

Boundary: The Entire Fish Creek Reservoir
Primary Pollutant-of-Concern: None
TMDLs Completed: None
Delisting: Bacteria, Dissolved Oxygen, Nutrients, Sediment
TMDL Modification: Waterbody is meeting standards for Bacteria, Dissolved Oxygen, Nutrients, and Sediment
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Maintain Status SCD Involvement	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	NA	-	-
USFS	NA	-	-
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Muldoon Creek (5288)

Boundary: Headwaters to Little Wood River
Primary Pollutant-of-Concern: Temperature
TMDLs Completed: Temperature
Delisting: Unknown
TMDL Modification: Waterbody is meeting standard for Unknown
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Maintain Status SCD Involvement	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Loving Creek (5289)

Boundary: Headwaters to Silver Creek
Primary Pollutant-of-Concern: Temperature
TMDLs Completed: Temperature
Delisting: Unknown
TMDL Modification: Waterbody not meeting standards for Temperature
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Maintain Status SCD Involvement	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys
IDL	NA	-	-
USFS	NA	-	-
BLM	NA	-	-
Other Parties:			
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Fish Creek (5650)

Boundary: Headwaters to Fish Creek Reservoir
Primary Pollutant-of-Concern: Sediment, Nutrients, Bacteria, and Temperature
TMDLs Completed: Sediment, Nutrients, Bacteria, and Temperature
Delisting: Dissolved Oxygen and Flow Alteration
TMDL Modification: Waterbody is meeting standards for Dissolved Oxygen and Flow Alteration
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Fish Creek (2522)

Boundary: Fish Creek Reservoir to Carey Lake
Primary Pollutant-of-Concern: Sediment, Nutrients, Temperature, and Flow Alteration
TMDLs Completed: Sediment, Nutrients, and Temperature
Delisting: Bacteria, Dissolved Oxygen
TMDL Modification: Waterbody is meeting standards for Bacteria and Dissolved Oxygen
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2045	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys
IDL	2045	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	NA	-	-
BLM	2045	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2045	BURP Program WBAG Process	IDEQ WQ Monitoring IDEQ WQ Assessment

Personnel from the various agencies involved in the interpretation of the time frame, approaches, and monitoring strategy are summarized as follows:

ISCC Personnel: Charles Pentzer, Water Quality Resource Conservationist
Joe Schwarzbach, Water Quality Resource Conservationist

IDL Personnel: Timothy C. Duffner, Area Supervisor, South Central Area, Gooding ID

USFS Personnel: Valdon Hancock, Hydrologist, Sawtooth National Forest, Region 4, Twin Falls Field Office

BLM Personnel: Doug Barnum, Supervisory Natural Resource Specialist, Shoshone Field Office

IDFG Personnel: NA

IDEQ Personnel: Jennifer Claire, Senior Water Quality Analyst – TMDL Writer
Dr. Balthasar B. Buhidar, Regional Manager – WQ Protection
Mike Etcheverry, Senior Water Quality Analyst

Appendix H. Data Sources

Table 86. Data sources for the Little Wood River Subbasin Assessment.

Water body	Data Source	Type of Data	When Collected
Muldoon Creek	DEQ, Twin Falls, ID	Flow, water chemistry, habitat, temperature	2001-2004
Muldoon Creek	USGS, website	Water chemistry	1975,1976,1977
Muldoon Creek	DEQ, Twin Falls, ID	Fish, macroinvertebrate, habitat data	2001
Fish Creek	DEQ, Twin Falls, ID	Flow, water chemistry, habitat, temperature	2001-2004
Fish Creek	DEQ, Twin Falls, ID	Fish, macroinvertebrate, habitat data	1993-2001
Loving Creek	DEQ, Twin Falls, ID	Flow, water chemistry, habitat, temperature	1975, 2001-2004
Dry Creek	DEQ, Twin Falls, ID	Flow, water chemistry, habitat	2001-2004
Dry Creek	BLM, Shoshone, ID	Habitat and macroinvertebrate data	2000
Little Wood River	DEQ, Twin Falls, ID	Flow, water chemistry, habitat, temperature	2001-2004
Little Wood River	DEQ, Twin Falls, ID	Fish, macroinvertebrate, habitat data	1993-2001
Little Wood River	USGS, website	Water chemistry	1973-1996
Little Wood River	USBR, website	Water chemistry	1998, 2000
Little Wood River	USGS, website	Flow	1896-1897, 1920-2003
Silver Creek	USGS, website	Flow	1920-2003

Appendix I. Distribution List

Balthasar Buhidar. Idaho Department of Environmental Quality, Twin Falls Office.
Clyde Lay. Idaho Department of Environmental Quality, Twin Falls Office.
Sean Woodhead. Idaho Department of Environmental Quality, Twin Falls Office.
Rob Sharpnack. Idaho Department of Environmental Quality, Twin Falls Office.
Mike Etcheverry. Idaho Department of Environmental Quality, Twin Falls Office.
Marti Bridges. Idaho Department of Environmental Quality, state office (Boise).
Mike McDonald. Idaho Department of Fish and Game, Jerome Office.
Terry Blau. Idaho Department of Water Resources, Twin Falls Office.
Water quality coordinator. Idaho Department of Lands, Shoshone Office.
Valdon Hancock. United States Department of Agriculture Forest Service, Twin Falls Office.
Codie Martin. United States Bureau of Land Management, Shoshone Office.
Chuck Caranaha. Idaho Department of Transportation, Shoshone Office.
Mark Dallon. Idaho Association of Soil Conservation Districts, Twin Falls ID.
Chuck Pentzer. Idaho Soil Conservation Commission, Jerome ID.
Steve Thompson. Natural Resources Conservation Service, Gooding Office.
Bill Hazen. University of Idaho County Extension Services, Gooding County.
Polly Huggins. Resource Conservation and Development, Gooding ID.
Karen Pratt. Nature Conservancy, Hailey ID.
Blaine County Soil Conservation District, Hailey ID.
Gooding County Commissioners, Gooding ID.
Blaine County Commissioners, Hailey ID.
Lincoln County Commissioners, Shoshone ID.
Idaho Rivers United, Boise ID.
Western Watersheds Project, Hailey ID.
Doug Pettinger. Glanbia Richfield and Gooding, Gooding ID.
City of Gooding, Gooding ID.
City of Shoshone, Shoshone ID.
City of Richfield, Richfield ID.
City of Carey, Carey ID.
Tess O'Sullivan, Lava Lake Livestock,
Roger Blew, Upper Snake BAG Committee, Rep-at-Large, Idaho Falls ID.
Matt Woodard, Upper Snake BAG Committee, Environment East Side Soil & Water, Idaho Falls ID.
Brian Olmstead, Upper Snake BAG Committee, Irrigated Ag, Twin Falls ID.
Hunter Osborne, Upper Snake BAG Committee, Sho-Ban Tribes, Fort Hall ID.
Brad Orme, Upper Snake BAG Committee, Livestock, St Anthony, ID.
Gary Marquardt, Upper Snake BAG Committee, Non-Municipal Permittee, Buhl ID.
Don Mays, Upper Snake BAG Committee, Recreation, Gooding ID.
Chris Randolph, Upper Snake BAG Committee, Hydropower, Boise ID.
Greg Shenton, Upper Snake BAG Committee, Local Government, DuBois ID.
Dennis Facer, Upper Snake BAG Committee, Mining, DuBois ID.
Mark Toone, Wood River WAG Committee, Gooding ID.
Clint Krahn, Wood River WAG Committee, Fairfield ID.
Bob Simpson, Wood River WAG Committee, Carey ID.

Rob Struthers, Wood River WAG Committee, Bellevue ID.
Jerry Nance, Wood River WAG Committee, Dietrich ID.
Carl Rey, Wood River WAG Committee, Fairfield ID.
Lee Brown, Wood River WAG Committee, Ketchum ID.
Roger Parker, Wood River WAG Committee, Hailey ID.
Dennis Strom, Wood River WAG Committee, Hill City ID.
Daryle James, Wood River WAG Committee, Hailey ID.
Kent Scott, Wood River WAG Committee, Gooding ID.
Carol Blackburn, Wood River WAG Committee, Shoshone ID.
Lynn Harmon, Wood River WAG Committee, Shoshone ID.
Jo Lowe, Wood River WAG Committee, Idaho Conservation League, Ketchum ID.
Dennis Koyle, Wood River WAG Committee, Gooding ID.
Bill Davis, Wood River WAG Committee, Fairfield ID.
Wood River SCD, Shoshone ID.
Bryan Ravenscroft, Wood River WAG Committee, Bliss ID.
Scott Boettger, Wood River WAG Committee, Ketchum ID.
Tom Pomeroy, Wood River WAG Committee, Ketchum ID.
Dwight Osborne, Wood River WAG Committee, Hagerman ID.
Bob Bolte, Wood River WAG Committee, Gooding ID.
Jack Straubhar, Wood River WAG Committee, Twin Falls ID.
Martha Turvey, EPA, Seattle WA.
Leigh Woodruff, EPA, Boise ID.

Appendix J. Public Comments

The 30 day public comment period closed on January 21, 2005 at 5:00 p.m. During this period comments were received from the Lava Lake Land & Livestock, L.L.C., the US Forest Service, the Idaho Department of Lands, and the US Environmental Protection Agency. Those comments that were editorial were incorporated into the document. The remainder of the comments are addressed in this appendix and DEQ's responses follow the comments in italics.

IDAHO DEPARTMENT OF LANDS PUBLIC COMMENTS

IDL #1. Page 25: "Publicly owned and managed by the State of Idaho". This statement needs to be clarified based on the actual classification of the State land. Three different State agencies manage land in this watershed with very different missions/objectives. The State Endownment Lands administered by Idaho Department of Lands (IDL) are more similar to private land than publicly owned land. IDLs mission is to "Manage endowment trust lands to maximize long-term financial returns to the beneficiary institutions; provide protection to Idaho's natural resources." Idaho Department of Fish and Game (IDFG) and Idaho Department of Parks and Recreation (IDPR) also administers State owned land within the area according to their respective missions and authority. In very rough figures, we estimate the breakdown of State land within this watershed as follows:
Endowment land – approximately 40,180 acres in multiple parcels (320 acres in the Normal School Endowment, remainder in Public School Endowment)
IDFG managed land – approximately 1,100 acres in 5 parcels
IDPR managed land – 400 acres in 2 parcels

These approximate figures were added as a footnote describing state owned land in Table 12.

IDL #2. Page 30: IDFG's Hayspur Fish Hatchery is listed in the narrative as a non-point source. However, on page 29 in table 14 and the map on page 31, it is listed as a point source. This discrepancy should be clarified.

Excerpts from an EPA letter were added to the document to clarify the classification of the Hayspur Fish Hatchery as a non point source rather than a point source. This is based on fish production and hatchery size, however, GIS coverage at this time still indicates that all hatcheries are point sources.

IDL #3. Regarding the Little Wood River Implementation Strategies (appendix E): We consider the timeframe and monitoring strategies identified for IDL on all of the segments to be attainable. IDL personnel involved in these TMDL comments and the future approaches and monitoring strategies identified in Appendix E are as follows: Tim Duffner (Area Supervisor), Meribeth Lomkin (Sr. Resource Manager), Jake Zollinger (Sr. Resource Manager), and Erik Kriwox (Resource Manager).

The implementation strategies incorporated into the document at the time did not represent the temperature TMDLs therefore some slight changes will be incorporated into the implementation strategies document.

LAVA LAKE LAND & LIVESTOCK, L.L.C PUBLIC COMMENTS

LLL&L #1. We noticed that temperature was added to the 303(d) list for Muldoon Creek and the Little Wood River from the headwaters to the mouth, but then later in the report you state that there is "no temperature exceedance in the headwaters of the creek. Upper stretches of the water body could act as a refuge for aquatic life…" (p.58, p.104). Please clarify which segments of the creek are suspected to be above desired temperature levels.

Temperature loggers were placed in headwater stretches of the water bodies to identify background temperatures on a water body if there were natural causes that were elevating the temperatures, such as geothermal springs, etc. However, there was not enough data collected in most water bodies and not enough minimally impacted land available in the subbasin to identify background levels.

Temperature was collected near the mouths of water bodies to determine if the water temperatures were meeting water quality standards. Temperature loggers were placed to determine if water quality standards were being met, not to determine which segments were meeting standards. When temperature standards were not being met, canopy cover targets on the creek were used as a surrogate method that would aid in reaching the desired in stream water temperatures. Canopy cover at any site of the creek that is not meeting the canopy cover target for that location could be contributing to an overall elevation in temperature throughout the system, even though temperature standards are still being met at that particular site. Eventually this accumulation of poor canopy coverage will lead to temperatures elevated above standards in the downstream segments.

LLL&L #2. We noticed that the report for Muldoon Creek cited an IDFG survey of Muldoon Creek from 1987 regarding the fishery. While we feel that this information may have been valid at the time, we think that it would be important to have some more recent information, particularly because the land ownership has changed (at least in part) since that time. Was the data from the 2003 IDFG fish survey of the area incorporated into this assessment?

The 1987 data collected by IDFG was mentioned as an aid in determining if CWAL and SS are existing uses within Muldoon Creek. As has been mentioned in the document existing uses are those uses that have occurred in the water body after November 28, 1975. The 1987 data was also mentioned as it may minimally help indicate changes within the system; however it was not used to determine the support status of Muldoon Creek. The 2003 fish survey completed by IDFG was not incorporated into the assessment as it was not available during the report compilation.

LLL&L #3. In terms of Fish Creek, we noticed that in Table 28 the list of activities affecting the upper reach does not include beaver dam complexes. There are several beaver complexes that extend into what we consider the upper portions of this stream (just before it becomes very steep).

The data in the tables describing the characteristics of the water bodies is data that comes directly from the BURP files. Either the BURP crew that collected the data did not notice the beaver dams, the beaver dams did not exist at the time, or the crew just neglected to mark it as an activity that was impacting the reach. This data is informational, and compiled with the information that was readily available.

LLL&L #4. In addition, we noted that the monitoring points for temperature, bacteria, and nutrient collection are all in close proximity to the reservoir. This location is not representative of conditions in the upper reaches of the watershed.

Monitoring sites at pour points allow us to see what is occurring in the water body as a whole, this does not necessarily tell us what is going on in certain segments of the water body or where the pollutant is specifically coming from. During the implementation planning phase, the designated land management agency should collect information concerning segments of concern. This information will be used to direct implementation projects.

LLL&L #5. Finally, the report indicates that The Nature Conservancy collected TSS samples in upper Fish Creek. This work was actually carried out by Lava Lake Land & Livestock (coordinated by Alan Sands of TNC under a contract with Lava Lake).

The appropriate adjustments have been made in the document.

THE US FOREST SERVICE PUBLIC COMMENTS

USFS #1. My concerns with the results are primarily proposals concerning Muldoon Creek and the Little Wood River (segment 1) within the Sawtooth National Forest. Within the Forest, these streams have no temperature exceedance, as you have noted. Considering this, it would seem to be inappropriate to put these segments on the 303(d) list as impaired waters. I am sure, though, that Forest Service managers all want to cooperate with you on useful targets designed to improve water quality. However, the dominant land use on National Forest land in this area is sheep grazing; there is no cattle grazing. I believe that sheep grazing has a negligible effect on stream canopy cover. Probably the roads along Copper Creek and Muldoon Creek have a greater impact on canopy cover; aside from those roads and past activities, the canopy cover may be very nearly natural conditions.

The purpose of the temperature TMDL is to meet water quality standards throughout the length of the water body. In order to do this canopy cover is used as a surrogate to aid in attaining water quality temperature standards. The source of impairment to canopy cover targets have not been identified, roads may be a contributing factor to the reduced canopy cover in the system. Data collected during the time period was limited, further data may need to be collected to identify critical areas throughout the length of the water bodies in which implementation of BMPs will aid in canopy cover and thus in water temperature.

<u>USFS #2.</u> I am concerned also because the paper presented by Mark Shumar at the January 2004 Nonpoint Source Water Quality Monitoring Results Workshop stated that available aerial photos could not be used to determine canopy coverage. However, aerial photos were likely all you had to develop existing cover, and until better measurements can be made, will have to do. Also, there are all south-facing drainages, most likely to be directly affected by the sun, in spite of cover.

Canopy cover data was also collected for each water body with the solar path finder. This data was used to determine that the aerial photo interpretations were consistent with the existing conditions. Further data collected in the implementation phase may refine the TMDL and the areas that need more work; it may also help us identify natural sources of temperature influence. The solar path finder data was not incorporated into the document during the public comment phase, but the document has been adjusted and now incorporates the field data.

<u>USFS #3.</u> The Implementation Strategies in Appendix E were pointed out as something DEQ would like help with. As water quality standards and probably canopy cover targets (to the extent that anthropogenic activities may be affecting them) a target of 2004 (already accomplished) as shown for other parties involved in Muldoon Creek (5288) is likely appropriate. The Grazing Allotment Permit is monitored, but a PFC process is not used. Please note that there is no National Forest land on the Little Wood River (2511) downstream of Richfield (or downstream of the Forest boundary in Township 3N, for that matter.)

The implementation strategies will be altered as they did not incorporate the temperature TMDL information. Muldoon Creek and the Little Wood River (segment 1) will be added to the strategy. The appropriate changes will be made for land ownership on the lower segment of the Little Wood River.

US ENVIRONMENTAL PROTECTION AGENCY PUBLIC COMMENTS

<u>USEPA #1.</u> Page 29 Table 14. Please explain why the Idaho Tire Recovery facility has no loading associated with it.

A paragraph has been placed in this section identifying that the facility does not discharge. Also see page 169, first paragraph after the subheading Load allocation, last sentence.

<u>USEPA #2.</u> Page xiv: The 50 mg/L TSS target is described as a yearly average target. Is this correct, or is it a monthly average target intended to be applied year-round.

This has been further described in the Analysis Process segment page 49 describing how TSS was analyzed.

<u>USEPA #3</u>. Page 30. Based on the feed rates of 70,000 to 80,000 lbs/yr, the Hayspur hatchery would be considered to be a point source, because it averages greater than 5,000 lbs feed per month. As such, an NPDES permit is required, and it should be treated as a point source in the TMDL, unless it can be shown to not be a contributor of pollutant loading to Loving Creek.

See the response to IDL #2.

<u>USEPA #4</u>. Page 36: Section 2.2. Applicable water quality standards. This section should describe the natural conditions provision of the Idaho water quality standards as they relate to temperature and point sources, used later in the temperature TMDL.

This has been added to the document more specifically point source language has been added to the appendix.

<u>USEPA #5</u>. Page xix, 48. 0.10 and 0.16 mg/L TP targets. The basis for these targets is identified as being the EPA Gold Book (1986). These recommendations were superseded by EPA Ecoregional Nutrient Criteria, which may be found at the following address: http://www.epa.gov/waterscience/criteria/nutrient/ecoregions/. We recommend that you consider these new recommendations in establishing phosphorous targets from streams in the Little Wood River Subbasin. We have serious concerns about using a total phosphorous trigger of 0.16 mg/L without further rationale for determining nutrient impairments. Levels far below this concentration are known to be associated with nutrient impacts, and TMDL goals for streams are typically much less than this.

The values described in the EPA Ecoregional Nutrient Criteria were considered, but it was decided were not applicable at this time.

<u>USEPA #6</u>. Page xix, 49. 35% substrate target. Numerous other sediment TMDLs in the region have used a substrate target of 28% depth fines based on information in Idaho sediment guidance. We recommend including data in the TMDL (or appendix) which supports the use of 35% fine sediment as a target which would protect for salmonid spawning and other aquatic life uses.

I have added a chart, Figure 17, which displays the bedload sediment (percent fines) data that occurs in streams in the subbasin that are meeting beneficial uses.

<u>USEPA #7.</u> Page 59. It would be helpful to describe the methods used to evaluate existing canopy closure, ie. the air photo interpretation. For example, detailed methods describing analysis methods could be included in an appendix to the TMDL. Also, I understand in talking with Mark Shumar that field verification of his air photo estimates were conducted using solar path finder readings. This type of information would be invaluable to include in the TMDL (appendix) to further support the validity of the air photo interpretation methods being used.

The solar path finder data has been added to the document to show comparisons between aerial photo interpretation and field data. An appendix has also been added to the document discussing aerial photo interpretation methodology.

USEPA #8. Page 138. Mines are considered to be point sources under the Clean Water Act and per federal definitions. If they are sources of sediment or nutrient loading to stream segments addressed by these TMDLs, they should be identified and included in the allocations.

There are no active mine sites in the subbasin at the time, based on current knowledge. Nor are any of the abandoned mines in the subbasin currently identified as CERCLA sites as a result they are identified as a nonpoint source component of the TMDL (Buhidar 2005).

USEPA #9. Page 143. Either here or in Section 2.2 it should be described how it is concluded that temperature exceeds criteria naturally, in order to justify the use of natural vegetation targets without an explicit link to meeting numeric temperature criteria.

This has been added to the document.

USEPA #10. Page 144. The MOS discussion specifically identifies a 10% MOS in the temperature TMDL, which is translated into a numeric heat load. However, the shade targets do not appear to be adjusted to take into account the MOS, ie. They have not been increased by 10%.

The MOS and FG allocations were misapplied to solar radiation loads for canopy cover TMDLS. Canopy cover targets address the potential natural conditions therefore MOS and FG should not be applied. These adjustments have been made in the temperature TMDLs.

USEPA #11. Page 144. For Muldoon Creek and other waters, only the cold water aquatic life temperature criteria are cited. The TMDL should indicate that salmonid spawning criteria should also be met where salmonid spawning is a designated or existing use.

In coordination with the state office, temperature issues related to point sources has been reevaluated and adjustments have been made in the document.

USEPA #12. Page 166. The TMDL states that "Waste load allocations are not made for these point source facilities and construction storm water sites for a sediment TMDL based on stream bank erosion or a temperature TMDL because they are unlikely to impact stream banks or canopy covers."

The municipal treatment plants and food processing facility are sources of both sediment and heat loading to the Little Wood River, so should receive a waste load allocation in the TMDL for these parameters.

At this time, point source facilities will be required to meet their current NPDES limits for TSS and construction storm water sites will receive 2% of the available sediment load.

For a temperature TMDL, canopy cover is being used as a surrogate to reach temperature water quality standards of the water body. The facilities do not impact the canopy cover therefore they will not receive a waste load allocation, however although they do contribute heat to the system.

If these sources are relatively small contributors of sediment to the system, one common option is to set their waste load allocation at the level of their current NPDES permit limits and the facilities design flow, with explanation in the TMDL that the intent is not to make their permit limits any more restrictive then they are currently.

TSS loads have been given to the point sources, with the explanation that their permits are not to be any more restrictive then they are currently.

Since the temperature TMDL is based on natural conditions provisions of the Idaho water quality standards, these facilities must not cumulatively increase receiving water temperature more than 0.3 C above the natural stream temperature (IDAPA 58.01.02__________)

A statement has been added to the temperature TMDLs that incorporates this standard as well as the way in which point source temperatures will be dealt with until natural conditions are restored to the water body.

Construction storm water may not be a source of heat loading during summer months when temperature criteria are exceeded due to the lack of precipitation, but it may be a source of sediment loading at other times of the year, and should receive a waste load allocation in the TMDL.

A waste load allocation for construction storm water has been added to the sediment TMDLs.

USEPA #13. Page 171 Table 70. I would suggest re-labeling the Suggested Load column to: Waste load Allocation.

USEPA #14. Page 171 Table 72. I would suggest re-labeling the Waste Load Allocation column to Total Waste Load Allocation. Also, the total waste load allocation for the upper segment should be 10.06 lbs/day rather than 11.38.

These changes have been made.

EPA #15. Excel loading spreadsheet. You should double check the conversion from MGD to cfs in the phosphorous loading table, I came up with slightly different cfs figures based on the MGD values given for all facilities, especially Glanbia-Gooding.

In looking up these values it was noticed that the design flows in cfs on the spreadsheet were miscalculated. These numbers were recalculated. As a result load allocations for the Little Wood River TP TMDL have been adjusted.

EPA #16. Page xix. Was there any observations of nuisance aquatic growth recorded during field investigations?

Field notes do not identify the type of aquatic vegetation or quantity within the water body. It was noted that there was aquatic vegetation in the segment of Fish Creek below the reservoir, in segment 4 of the Little Wood River, Loving Creek, and Muldoon Creek.

EPA #17. Page 10. It would be helpful to include a description of land-use types and erosion rates if it is part of the calculation to determine contributions to sediment loading.

A soil erosivity map has been added to the document to identify areas that may be more critical areas within the subbasin based on soil erosivity (K factors).

EPA #18. Page 18. It would be helpful to describe what anthropogenic activities contribute to the rise of E. coli levels in the summer months.

This graph was created from all of the water bodies that were monitored. As a result, the activities causing the rise could vary from water body to water body, but I will list some activities that could be influencing this increase within the subbasin.

EPA # 19. Page 29. Table 14. Is the design flow for Shoshone wastewater correct? Also, what is the design flow for the Glanbia Gooding food processing facility?

See EPA comment #15.

EPA #20. Page 51. The K factors are provided but without providing context to describe if this region has a relatively high or low erosion potential. A description of what a K factor is and a map describing these soil conditions would be helpful in the main body of the document.

See EPA comment # 17.

EPA #21. Page 110.This discussion comparing old data to more recent data collection would be stronger if you could provide more details on how many samples were collected in the more recent studies or provide references in an appendix.

The number of samples in the recent data was listed in Table 43. Little Wood River (segment 2) water chemistry data.

EPA #22. Page 137. The Hayspur Hatchery should be added as a point source to table 51.

See IDL Comment # 2.

EPA #23. Page 165. Please include the erosion rates and calculations either in this section or appendix.

The summary sheets for each creek with a sediment TMDL was already done, in addition to this stream bank erosion inventory methodology was added to the appendix.

EPA #24. General Comments. In many of the water body segments macroinvertebrate data and habitat data were mentioned as having been collected but no additional summary information is included. It would be helpful to have a summary of this information to support observations made about other conditions of the stream segments.

More information about macroinvertebrate data will be added for each water body.

EPA #25. General Comments. Field observations and documentation methods should be included in the appendix.

Field observations are part of the administrative record and are available for review, although they are not a part of this document. Explanations of methodology for aerial photo canopy cover interpretations and stream bank inventories have been added into the document.

EPA #26. General Comments. I recommend including information on whether a stream segment is intermittent or perennial in a table with what has been done in terms of assessments as a way to summarize this information.

A table describing available data and intermittent/perennial status of the 303(d) listed water bodies has been added to the document.